

THURSDAY, NOVEMBER 16, 1871

NEW WORKS ON MECHANICS

Lehrbuch der Mechanik in elementarer Darstellung mit Uebungen und Anwendungen auf Maschinen und Bau-Constructionen. Von Ad Wernicke. Vol. I. (Braunschweig, 1871. London: Williams and Norgate.)

Lehrbuch der physikalischen Mechanik. Von Dr. Heinrich Buff. Vol. I. (Braunschweig, 1871. London: Williams and Norgate.)

An Elementary Course of Theoretical and Applied Mechanics. By Richard Wormell. Second Edition. (London, 1871. Groombridge and Sons.)

WERNICKE'S work is intended for pupils in the Prussian industrial schools (*Gewerbeschulen*). The first volume treats of Statics and Dynamics, leaving Hydro-mechanics for the second. According to the preface, students reading this work should be acquainted with elementary mathematics, including co-ordinate geometry, while a knowledge of the differential calculus is not required. From an English point of view, it is not desirable to draw the line between co-ordinate geometry and the calculus. Even in our universities, not twenty per cent. of the students are acquainted with co-ordinate geometry. It is to be regretted that the proportion is so small; that it is so, is due to the present preposterous system of classical education, that relic of the middle ages which is the bane of our schoolboy days. Almost all English students, however, who learn co-ordinate geometry, generally study both the differential and integral calculus before commencing mechanics. Now intelligent pupils like a text-book of mechanics in which they find scope for exercising all their mathematical knowledge; hence it would appear that for English purposes the line is drawn either too high or too low.

As to the manner in which Wernicke has executed his task, it would be hard to speak too favourably; and notwithstanding the point we have raised, we should hail an English translation as a valuable addition to our standard works on mechanics. One of the best features in the book is that it presents theoretical and practical mechanics not as two distinct subjects, but in that degree of combination which naturally belongs to them.

The first volume of Wernicke's work consists of 500 octavo pages, and is divided into three parts. Part I. discusses the Kinematics of a mathematical point, the inquiry being principally confined to space of two dimensions. The symbol j is here and throughout the work used to denote an acceleration: for example, jx is the acceleration parallel to the axis of x . This notation (unfamiliar to English readers) has obvious advantages when the more appropriate language of the differential calculus cannot be employed. About fifty examples, many of a practical character, are appended to Part I. Among them is found (Ex. 31) a problem virtually requiring the integration of x^2 . The solution given is necessarily roundabout and cumbrous, owing to the restraint which the author has imposed upon his use of mathematics. It may, indeed, be questioned whether a student who is not acquainted with the integral calculus could really

profit by a solution which is merely the integral calculus ground down and spoiled.

Part II. is upon the Mechanics of a material particle. We notice here small points in the diagrams which must be useful to the learner. Thus, in a figure where the length of a line is denoted by a symbol, the extremities of a bracket indicate the extremities of the line. Those who use the black-board in teaching will appreciate the advantage of this detail. Take, for example, Fig. 54, which refers to motion in an ellipse about a force in the focus. In this part and the examples appended, the usual proportions relating to the statics and dynamics of forces applied at a single point will be found.

The third part, which treats of the mechanics of a rigid body, occupies four-fifths of the volume. Chap. I. discusses the Composition and Equilibrium of Forces in space; some of the examples require a good deal of honest numerical work, others are well-known questions not involving friction. Chap. II. is on the Centre of Gravity; in this we do not notice much that is unusual, except the excellence of the illustrations. The examples contain problems on the centre of gravity of various useful areas and volumes, the theory of the arch, and many other subjects.

In Chap. III. we have a treatise upon Friction. We miss here an actual description and discussion of a series of experiments from which the laws of friction are established. This omission is to be regretted, because the laws are only approximate, and it is important for the pupil to have materials presented to him from which he can form his own estimate of their correctness. Intelligent pupils would have been pleased to find how true the laws are on the whole, and interested in noting the discrepancies. No good opportunity for introducing and discussing the results of experiments should have been lost in a work of this kind. With this exception, the force of friction has been treated in a manner worthy of its importance; we find its effect upon the various mechanical powers, upon toothed wheels and brakes, and in many other cases, treated in an excellent manner. Chap. IV., on the Motion of a rigid body, very properly commences with the exquisite kinematical theorems of Poinot. D'Alembert's principle follows, and also a table of moments of inertia, which will be found a useful aid in recollecting these troublesome quantities.

Chap. V., on Elasticity and Rigidity, is certainly the best chapter in the book. Problems connected with the deflection of a beam are among the most interesting questions of mechanics. We have here an exceedingly careful discussion of this subject, not too much encumbered with formulæ. A large number of examples thoroughly worked illustrate this chapter. Every teacher of applied mechanics will find these examples invaluable; they are far better than those on the same subject in any other book with which we are acquainted.

Finally, in estimating the merits of this work, we must recollect that it is a manual for class instruction; it is not, nor does it profess to be, a comprehensive and original treatise, like the great work of Weisbach.

Buff's work, of which the first volume is before us, is of somewhat different character to that of Wernicke. It bears the same marks of painstaking thoroughness which characterise the better class of German works on science.

The illustrations are also unusually good in both books, but while Wernicke's is professedly a mathematical treatise, the work of Buff leans more to the physical aspects of mechanics. There is, however, considerable reference to mathematics in Buff, in fact, he makes free use of the calculus when necessary.

The book consists of thirteen sections :—Section I. is on Rest and Motion ; Section II. on Movement in Space and Time : this contains, in addition to the usual theorems on the motion of a point, a useful article on harmonic motion. Section III. introduces the Composition of Movements ; in this will be found a discussion of experiments upon the trajectory of the bullet from the needle-gun. Section V. commences the subject of Mechanical Work ; we are glad to see in this book the principle of work receives that prominence which it unquestionably deserves. Section VII., on Friction, discusses, among other subjects, Pambour's experiments upon the friction of railway carriages. Section IX., upon the Efficiency of Machines, is admirable, the theory being properly proportioned to the experiments. We find here a full discussion of the subject, without that deluge of formulæ which is so often repulsive to those in search of distinct physical conceptions. Section X. contains what is familiar to us by the term Mechanism ; Section XII. is the most complete account of Centrifugal Force which we have met with in any work ; we have here a physical explanation of the permanent axes, of precession and nutation, of the mode of finding the masses of the heavenly bodies, and of various other matters. Section XIII., upon the Motion of the Pendulum, is a collection of interesting subjects, among them Foucault's pendulum, and a far better account of Cavendish's experiments than is to be found in any English book on mechanics. We are also a little surprised to find the weighing scales treated in this section. The arrangement is novel, and though doubtless much might be said in favour of it, yet we think, on the whole, it is not convenient.

We cordially recommend Buff's treatise to the notice of teachers of natural philosophy.

Mr. Wormell's book, which appears to have been specially intended for the London University examination for B.A. and B.Sc., contains practical and experimental illustrations, in addition to the usual matter. We should gladly welcome a thoroughly good work on the general plan which has been adopted by Mr. Wormell, but the book before us ought to receive careful revision before it is placed in the hands of students. We shall indicate some of the points that we have noticed which require correction. We do so in the belief that a future edition of the work might be made really valuable, and supply a much felt want. Some of the errors are common to this work and other text-books. We can, therefore, only accuse Mr. Wormell of reproducing them, but we cannot allow this excuse on every occasion.

On page 14, we find as follows :—"Any two forces F' , F'' applied at a point M may be transferred parallel to themselves to any other point M' in the line of direction of the resultant."

This proposition, if true, would assert that the attractions of the earth and sun upon the moon might be transferred to any heavenly body in space which happened to be in the line of direction of the resultant of the forces. The geometrical proof of the composition of parallel forces (p.

33) is meaningless, until the proposition referred to has been properly stated. This blunder is extremely common, it arises from enunciating as a property of forces what is really the definition of a rigid body.

On page 112 we find the following passage :—

"1. When the materials composing the surfaces in contact remain the same, the friction varies as the pressure. Suppose, for example, that a block of wood, having a hole bored in it, rests on a plane inclined at the angle of repose, if lead be poured in the hole, *the screw may be turned so as to incline the plane at a greater angle without causing the body to slide.* By increasing the pressure we increase the friction."

This is very bad ; the statement we have italicised in the second paragraph is entirely erroneous. So serious an error would be quite inexcusable even in one of those for whose use the book has been written.

We should have liked to have seen more experiments upon the mechanical powers cited. A student who reads (p. 94) that in the three sheave pulley-block the power is one-sixth of the load, will naturally be surprised when he finds by trial that the power must be one-fourth of the load ; nor can we find a single word in the book which would enlighten his difficulty. We should also have expected that the author would have replaced the antiquated and useless pulley systems which only exist in manuals, by some compact and useful machines like the differential pulley.

Such are some of the points which we consider to require careful revision before Mr. Wormell's book can be pronounced suitable for the use of students.

OUR BOOK SHELF

Contributions to Botany, Iconographic and Descriptive.

By John Miers, F.R.S., F.L.S. Vol. 3, containing a complete Monograph of the Menispermaceæ. Sixty-six litho plates. (London : Williams and Norgate, 1864—1871.)

MR. MIERS'S long-promised Monograph of the Menispermaceæ forms the third volume of his valuable "Contributions to Botany." The intimate acquaintance of this veteran botanist with South American plants, and his long study of this particular family, extending over more than twenty years, render his observations peculiarly valuable to all systematic botanists. Although in some important particulars Mr. Miers combats the views of such high authorities as the authors of the "Flora Indica," and those of the "Genera Plantarum," he adduces reasons for his dissent, which will, at least, need careful consideration from all who hereafter write on these plants. Mr. Miers retains, with some modifications, his views of the structure of the different organs in this order published in the Annals of Natural History in 1851, and classifies the genera which constitute it into seven tribes, on characters dependent mainly on the structure of the fruit, and on the position of the cotyledons relatively to the radicle, whether incumbent or accumbent. The establishment of sixty-four distinct genera in the order, instead of the thirty-one admitted by Bentham and Hooker, may be open to criticism, but several of them contain only single species now for the first time described, which appear to be altogether aberrant types of the order. Good plates are always valuable ; and we have here sixty-six, drawn on stone by the author himself, containing careful dissections to illustrate the salient characters of the genera and more important species. This concluding volume of Mr.